

REMARKS

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "Version with markings to show changes made." Claims 5, 8, 9, 10, 13, 18, 24 and 25 are presently amended simply to clarify the claims and are not made in response to a rejection by the Examiner. The amendments do not narrow the scope of the Claims. No new subject matter is added.

1. Drawings

The Examiner states that the "drawings are objected to under 37 C.F.R. 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the 'pulses' of 'same currents with opposite polarities' of claim 25 must be shown or the feature(s) canceled from the claim(s)."

Amendments to the drawings are addressed under a separate letter. The amendments to the drawings add no new matter. With regard to the language of Claim 25 quoted by the Examiner, Figure 5 clearly shows "pulses" 202 and 210 of "currents with opposite polarities" I1 and -I2. When I2 is set to I1, the "pulses" then have the "same currents with opposite polarities." Additionally, amendments to the drawings are made to illustrate the invention (e.g., as claimed in Claim 23). Reconsideration and withdrawal of this objection are requested.

2. Claim Rejections - 35 U.S.C. §112

The Examiner stated that "Claims 18-20 and 23-25 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention."

Claims 18-20 and 23-24

Applicants respectfully traverse the Examiner's rejection of Claims 18-20 and 23-24. If the Examiner maintains this rejection after consideration of the Claims and amended Figures, Applicants respectfully request the Examiner to clarify the rejection and to point out with specificity the subject matter believed indefinite.

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Claim 25

With respect to Claim 25, the Examiner states that “there is no support found in the specification for the language therein.” As presently amended, Claim 25 recites a “plurality of prepulses have approximately the same current with each prepulse having an opposite polarity from the preceding prepulse.”

Applicants respectfully traverse the Examiner’s rejection. The Examiner’s attention is directed to the as-filed Specification, which has ample support for the language of Claim 25. The Specification states: “a plurality of current limited pulses are generated, e.g., a second full voltage, current limited pulse is generated with opposite polarity from the initial current limited pulse. If desired, additional current limited pluses may be generated, e.g., each having the opposite polarity from the preceding current limited pulse.” (Specification, page 8, line 32, to page 9, line 2. Additional support may be found at page 8, line 9.) The Specification also states “A second prepulse 210, which has opposite polarity, follows prepulse 202. **The second prepulse 210 may have the same, less, or greater magnitude current as the initial prepulse 202.**” (Specification, page 8, lines 14-16.) The Specification clearly supports the language “plurality of prepulses have approximately the same current with each prepulse having an opposite polarity from the preceding prepulse” as recited in Claim 25. Reconsideration and withdrawal of this rejection are therefore requested.

Examiner’s Comments

The Examiner further states:

It is not seen that Applicant has directly responded to the above rejection. It is not seen that the amendment to Figs. 2 and 5 address that above rejection concerning the “currents” be approximately the “same”. The language in claim 25 is seen to be misdescriptive with respect to the specification and is seen to contradict claim 22, which states that the “currents” are different.

It is believed that the Examiner incorrectly equates the magnitude of the first current of the prepulse to the magnitude of the second current of the programming pulse. Specifically, Claim 22 recites a “prepulse including a first current” and a “programming pulse including a second current.” Claim 25, which indirectly depends on Claim 22, recites a

“plurality of prepulses having approximately the same currents.” Clearly, the plurality of prepulses have currents of a magnitude approximately the same as each other, that is, as the “first current” of Claim 22. Additionally, neither Claim 22 nor Claim 25 recites that the same magnitude as the magnitude of the “first current” is the same as the “second current.”

Reconsideration and withdrawal of this rejection are requested.

Further, Claims 5, 8, 9, 10, 13, 18 and 25 are amended to improve their form.

3. Claim Rejections - 35 U.S.C. §102

The Examiner stated that:

Claims 1-3 and 5-25 are rejected under 35 U.S.C. § 102(b) as being anticipated by Chan (cited by Applicant). Chan discloses, in Figs 2-4, a method having the steps of “passing a current limited pulse (pulse 210.1 of Fig. 2)”; and “passing a second pulse (pulse 210.2 of Fig. 2)”, providing the operation as recited by Applicant. Reference is made to Cols. 3-4 of Chan which express that the provision of I2 being less than I1 is merely as an example. It is clear from Cols. 3-4 of Chan (as well as other portions thereof) that the disclosed circuit is not limited to I2 being less than I1. It is further clear that one skilled in the art will get similar results wherein I2 is greater than I1, however, the reduction of resistance of the [sic] will not be as consistent.

Examiner has considered Applicant’s remarks for the above rejection and has not found them to be persuasive. Although it is clear that the reference to Chan prefers that current I1 be greater than I2, it is further clear that I1 can in fact be less than I2 and one would still obtain the benefit of the invention, although the deviation of resistance may not be as consistent.

Applicants respectfully traverse the Examiner’s rejection under §102. With regard to independent Claims 1, 9, 19 and 22, Chan does not disclose a “current limited pulse” (Claim 1) or a “prepulse” (Claims 9, 19 and 22) having a current “lower than” the current of a “second pulse” (Claim 1) or a “programming pulse” (Claims 9, 19 and 22). In fact, Chan does not even disclose a “current limited pulse” or a “prepulse”. Chan simply discloses repeating a sequence of programming pulses where the first programming pulse has a current having the same or greater magnitude than the second programming pulse. The

magnitude of the current of the first pulse of Chan is not lower than the magnitude of the current of the second pulse.

Similarly, with regard to independent Claim 21, Chan fails to disclose “wherein said first current having insufficient magnitude to produce a conductive filament with said second cross sectional area”. Each pulse described in Chan is a programming pulse. Reconsideration of Claims 1-3 and 5-25 is therefore requested.

4. Allowable Subject Matter

The Examiner indicated the allowability of Claim 19 if Claim 19 recited that the “third magnitude” is different that the “first magnitude.” Amended Claim 19 recites “wherein said current of a first magnitude is lower than said current of a second magnitude.” Clearly the prepulse having a “first magnitude” is different that the programming pulse having a “second magnitude.” As presently amended, Claim 19 also recites “wherein said current of the third magnitude has an opposite polarity from said current of the first magnitude.” Clearly, the “prepulse” and “second prepulse” of Claim 19 have different currents (i.e., currents of “opposite polarity”). Reconsideration of amended Claim 19 is requested. The amendments to Claim 19 are to put Claim 19 in condition for allowance, and hence is entitled to entry under Rule 116.

5. Allowed Claim

The Applicants appreciate the Examiner’s allowance of Claim 4.

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CONCLUSION

For the above reasons, Applicants respectfully request entry of this amendment under Rule 116 and allowance of all pending Claims 1-3 and 5-25. Should the Examiner have any questions concerning this response, the Examiner is invited to call the undersigned at (408) 453-9200.

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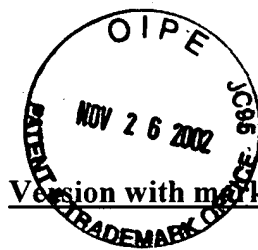
Respectfully submitted,



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Version with markings to show changes made

In the Specification

The paragraph starting at page 8, line 11, and ending at page 8, line 18, is amended as follows:

Fig. 5 shows programming pulses that include a plurality of current limited prepulses that may be used to program antifuse 100 in accordance with another embodiment of the present invention. As shown in Fig. 5, an initial prepulse 202, which is at full voltage and is current limited, is used to move the conductive filament 113 into amorphous silicon 112. A second prepulse 210, which has opposite polarity, follows prepulse 202. The second prepulse 210 may have the same, less, or greater magnitude current as the initial prepulse 202 and e.g., has a current I_2 that is limited to 3mA to 7mA. It should be understood that while two prepulses, i.e., prepulses 202 and 210, are shown in Fig. 5, any desired number of [prepulses] prepulses maybe used.

In the Claims

Please amend Claims 5, 8, 9, 10, 13, 18, 19, 24 and 25 as follows.

5. (Amended) The method of Claim 1,

wherein passing [a] said current limited pulse through said material comprises applying a first voltage to said first conductive element and applying a second voltage to said second conductive element, said second voltage being greater in magnitude than said first voltage, and limiting the current to a desired magnitude; and

wherein passing [a] said second pulse through said material comprises applying said second voltage to said first conductive element and applying said first voltage to said second conductive element.

8. (Twice Amended) The method of Claim 7, wherein passing [a] said plurality of current limited pulses through said material comprises passing at least two current limited pulses through said material, said at least two current limited pulses being opposite in polarity.

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9. (Twice Amended) A method of programming an antifuse, said antifuse comprising a material that is substantially non-conductive when said antifuse is unprogrammed, said material being disposed between and in electrical contact with a first conductive element and a second conductive element, said method comprising:

applying a prepulse to said material, said prepulse having a current of a first magnitude that drives material from said first conductive element into said material as a conductive filament; and

applying a programming pulse to said material, said programming pulse having a current of a second magnitude that drives material from said second conductive element into said material adding to said conductive filament;

wherein said current of [a] said first magnitude is lower than said current of [a] said second magnitude, and wherein said prepulse is applied prior to applying any programming pulses.

10. (Amended) The method of Claim 9, wherein said current of [a] said second magnitude is 20 to 33 percent greater in magnitude than said current of [a] said first magnitude.

13. (Amended) The method of Claim 12, further comprising applying a second programming pulse to said material, said second programming pulse having a current of a third magnitude, said current of said second programming pulse being applied in the same direction of said current of said prepulse.

18. (Twice Amended) The method of Claim 9, further comprising applying at least one additional prepulse to said material prior to applying said programming pulse.

19. (Twice Amended) A method of programming an antifuse, said antifuse comprising a material that is substantially non-conductive when said antifuse is

unprogrammed, said material being disposed between and in electrical contact with a first conductive element and a second conductive element, said method comprising:

applying a prepulse to said material, said prepulse having a current of a first magnitude that drives material from said first conductive element into said material as a conductive filament; and

applying a second prepulse to said material after said applying [a] said first prepulse to said material, wherein said second prepulse has said current of a third magnitude;

applying a programming pulse to said material, said programming pulse having a current of a second magnitude that drives material from said second conductive element into said material adding to said conductive filament;

wherein said current of [a] said first magnitude is lower than said current of [a] said second magnitude, and wherein said prepulse is applied prior to applying said programming pulses; [and]

wherein said current of said third magnitude is lower than said current of said second magnitude, wherein said current of said third magnitude has an opposite polarity from said current of said first magnitude, and wherein said second prepulse is applied prior to applying said programming pulse; and

wherein said first prepulse has approximately the same voltage with opposite polarity as said second prepulse.

24. (Twice Amended) The method of Claim 22, further comprising applying at least one additional prepulse to said material wherein said at least one prepulse and said at least one additional prepulse define a plurality of prepulses.

25. (Amended) The method of Claim 24, wherein said plurality of prepulses have currents of approximately the same [currents] magnitudes with [opposite polarities] each prepulse having a current of an opposite polarity from an immediately preceding prepulse.